



Accident Investigation, Human Factors, and Safety:

A lifetime of passion

Robert Sumwalt
Membre Associé Etranger, AAE



Windy, Cold

Partly cloudy, windy and cold. Highs around 45, northwest to low 40s along coast. Low runs 7:20 a.m., snow 2:15 p.m. Details, 14-4.

The State



82nd Year — No. 355

2 Sections — 56 Pages

Columbia, South Carolina

Friday, December 21, 1972

Daily 15¢



Plane Crashes Near Airport

A two-engine plane crashed in a wooded area between Burnhamville and Platt Springs roads Thursday while making a westward approach to the Columbia airport. The senior vice president of the Federal Land Bank of Columbia, J. Chappell Moore, 36, and the pilot Michael O. Frederick, 36, were killed instantly. Another bank executive Rex D. Price, 35, is in satisfactory condition. Another person, 14, (Staff Photo by Mike Roberts)

Frederick, 36, were killed instantly. Another bank executive Rex D. Price, 35, is in satisfactory condition. Another person, 14, (Staff Photo by Mike Roberts)

Air Crash Kills Two

Flood Of Bills Sent To Nixon

WASHINGTON (AP) Congress sent to President Nixon more than 100 bills and resolutions today.

West To Push 2nd Med School

By LEVINA PAGE

10-Gallon Limit Asked

'Merry Christmas From The Grid'

WASHINGTON (AP) — Energy chief William E. Simon wished everybody "a Merry Christmas from the Grid." Thursday, then asked motorists moving up for two long holiday weekends to use only 10 gallons of gasoline per week.

Simon promised a decision whether or not to order gasoline rationing by New Year's Day.

Meanwhile, restrictions on the number of days in the week a person can drive his car are being considered, material supplied to key members of Congress indicates.

Also under consideration is extension of the Sunday ban on gasoline sales to a normal day of the week, the material indicates.

The proposed mandatory restrictions were among a list of 26 energy conservation measures submitted by Simon Wednesday night to Senate conferees considering emergency energy legislation, according to Sen. Paul J. Fannin II-Ind.

Fannin, who made the list available to the Associated Press Thursday, said the items were specified by Simon as those which the administration wants to be free to impose if it decides to do so during the month-long congressional break without fear of a veto when Congress returns.

best who — in a well-known story — tries to steal all the Christmas.

Simon also developed a letter stating at the Pentagon by now that he was drawing 1.2 million of oil held from military stocks U.S. international system to be through a law which will be out early.

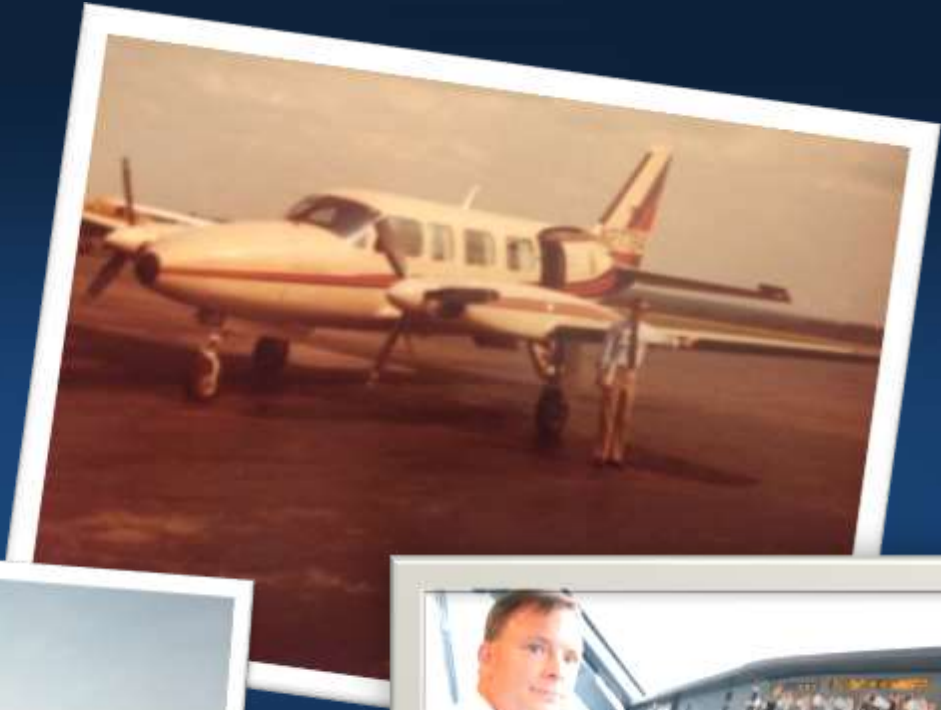
Limiting Gas Frustrating To Columbia

By PETER BERMAN
News Staff Writer

A federal proposal calling for limits to voluntarily limit driving 10 gallons of gasoline a week is greeted with more frustration than enthusiasm by Columbia area residents.

Administrative energy chief E. Simon, South Carolina's







August 2005



2006



2011



2017

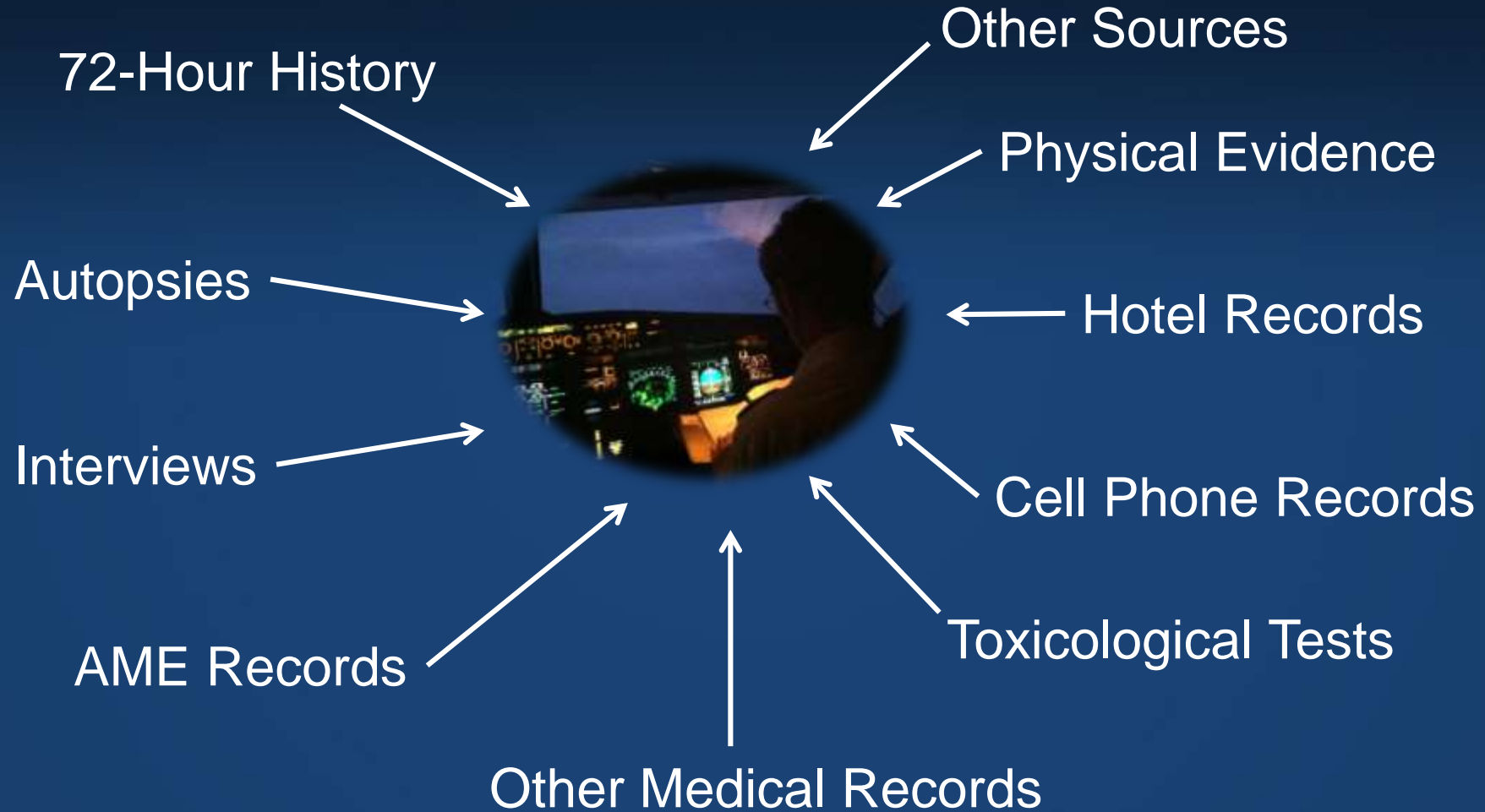




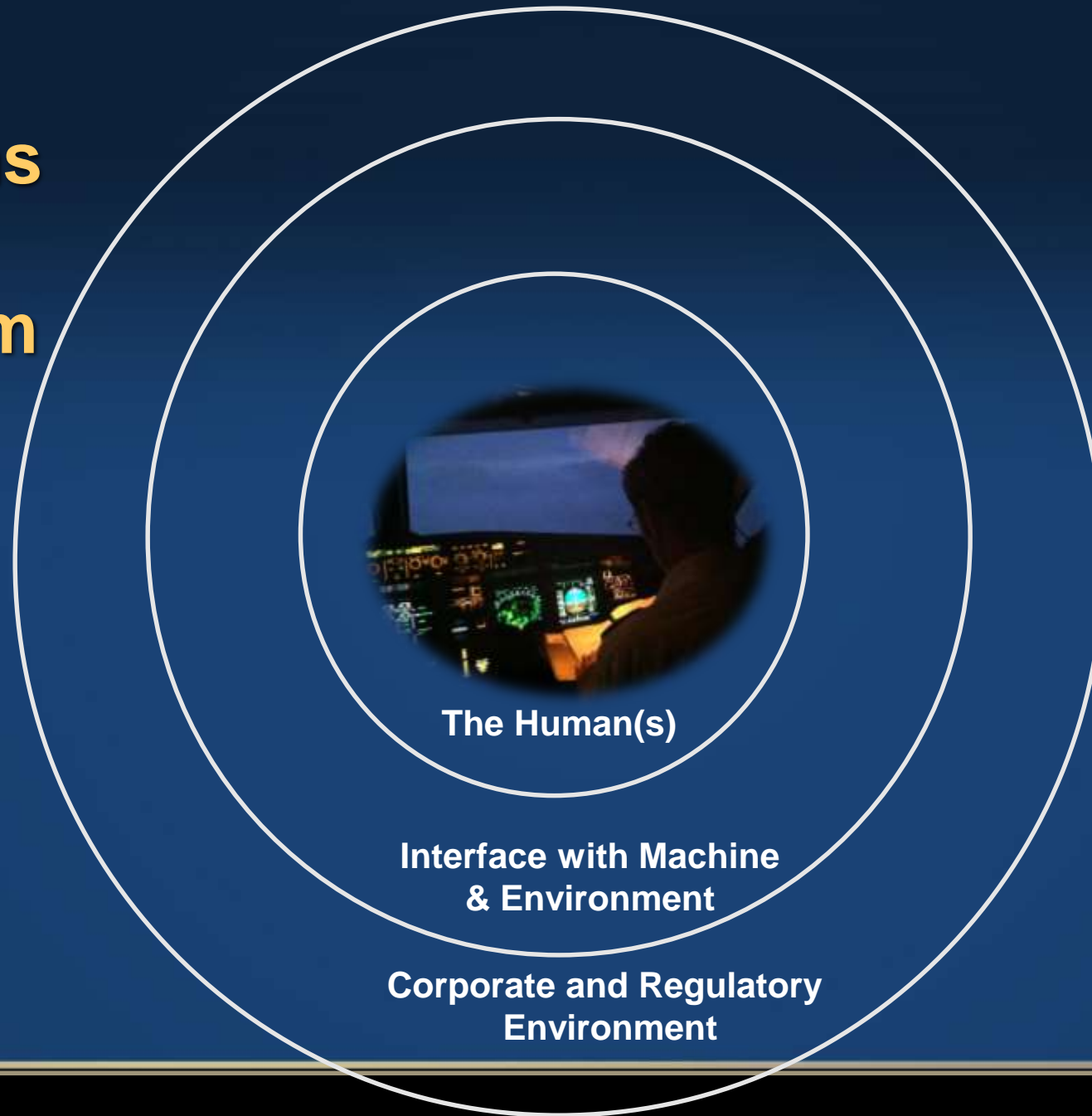
Human factors is a multidisciplinary science that examines the relationship between humans and the systems with which they interact, including...

Ergonomics
Engineering
Psychosocial interactions
Decision-making
TEM
Fatigue
Psychology
Physiology
Human-centered design
Information processing
Biomechanics
Medicine
Study of organizational issues
National cultural influences
Anthropometrics
CRM
Resilience engineering
Automation management
Communications

Potential Sources of Information



NTSB Investigations Examine the Entire System



TRAINED FOR LIFE:
HUMAN-CENTERED
APPROACH TO SAFETY

System Safety Order of Precedence*

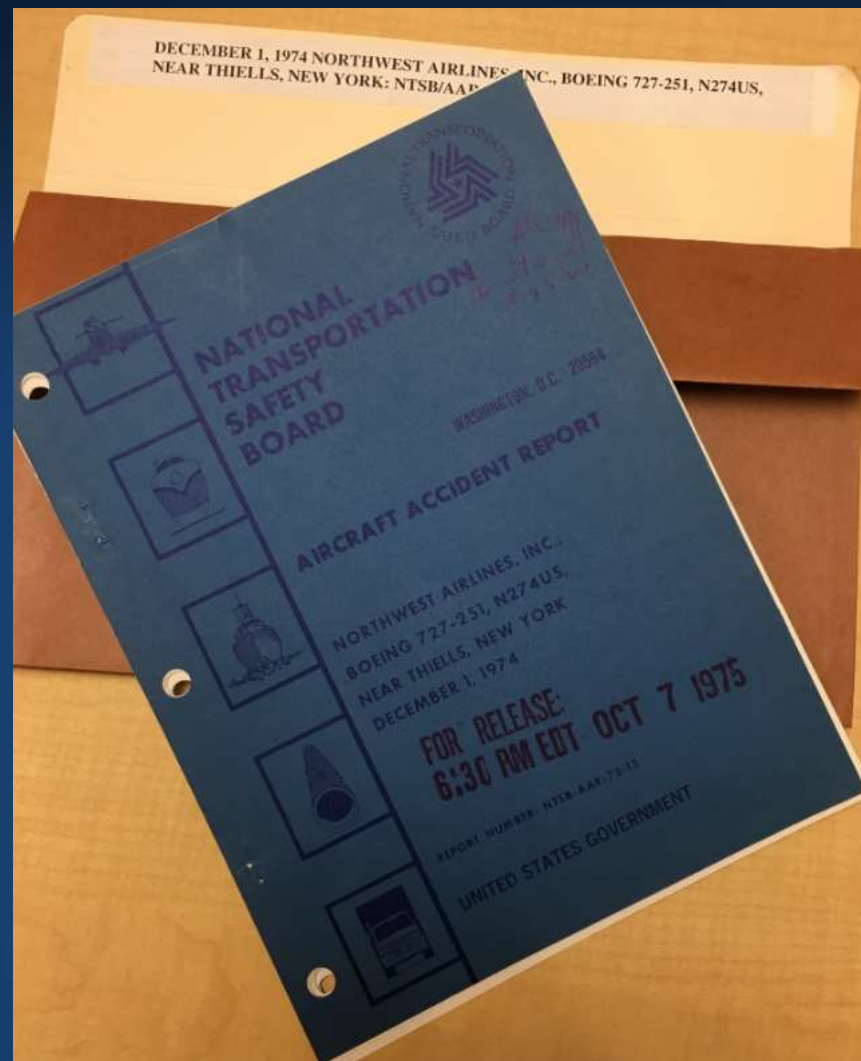
1. Eliminate the hazard through **Design/Engineering Features**
 - Hazard is corrected and eliminated
2. Incorporate **Guards/Safety Devices**
 - Guards put up to decrease exposure
3. Provide **Warning Devices**
 - Warn personnel if you can't eliminate or control the hazard
4. Develop **Procedures** and **Training**

*Also know as “Hierarchy of Controls.”

Source: MIL-STD-882E

ROBERT'S HF PREMISE # 1

If you design out the problem, you design out the problem. <duh>



ROBERT'S HF PREMISE # 2

If you design something with enough complexity, don't be surprised if someone can't use it when they really need it.

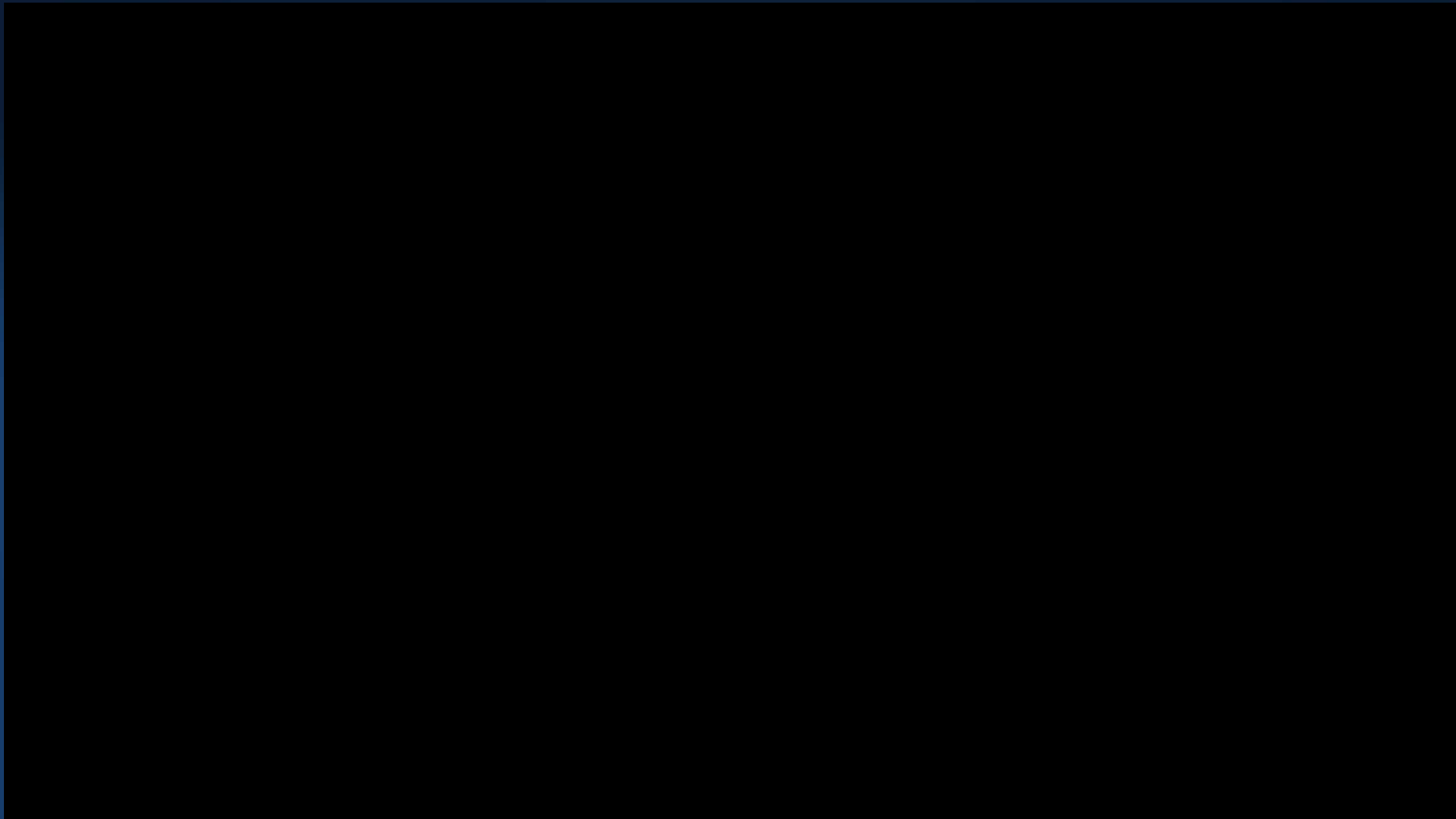
American 383, October 28, 2016



Rejected takeoff



Evacuation





ROBERT'S HF PREMISE # 3

If you don't account for human error, you, yourself, have made a very basic human error.



**National
Transportation
Safety Board**

Loss of Control at Takeoff

Frisco, Colorado
July 3, 2015
CEN15MA290

NTSB Finding

- “The design of Airbus Helicopters dual-hydraulic AS350-series helicopters did not account for the possibility of pilot error in configuring the tail rotor hydraulic circuit ...”

In-Flight Breakup During Test Flight

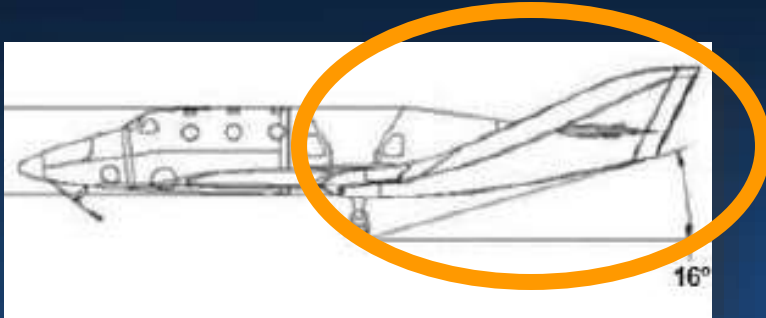
October 31, 2014

SpaceShipTwo

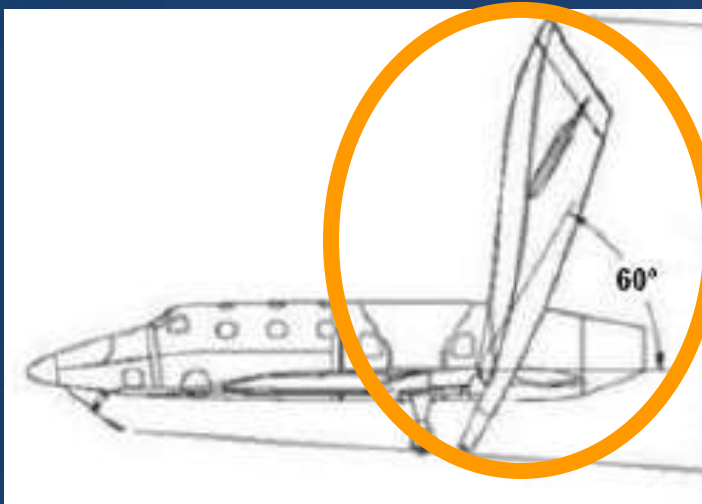




SpaceShipTwo Feather System



Feather retracted



Feather extended

Feather Lock Handle

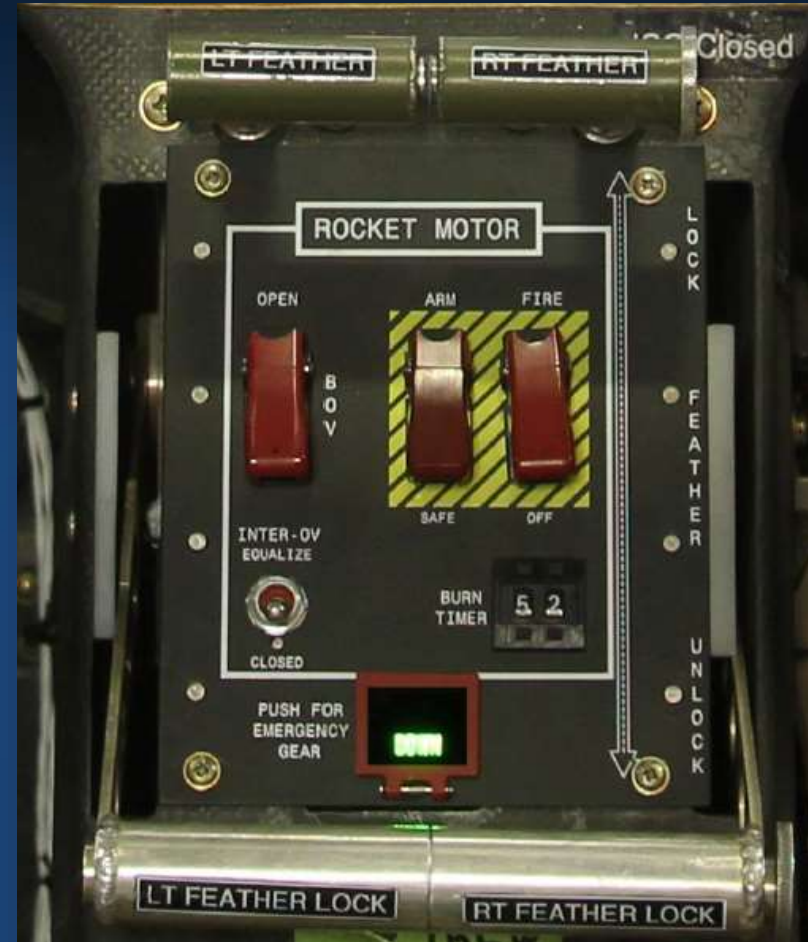


Feather Locked

Lock



Unlock

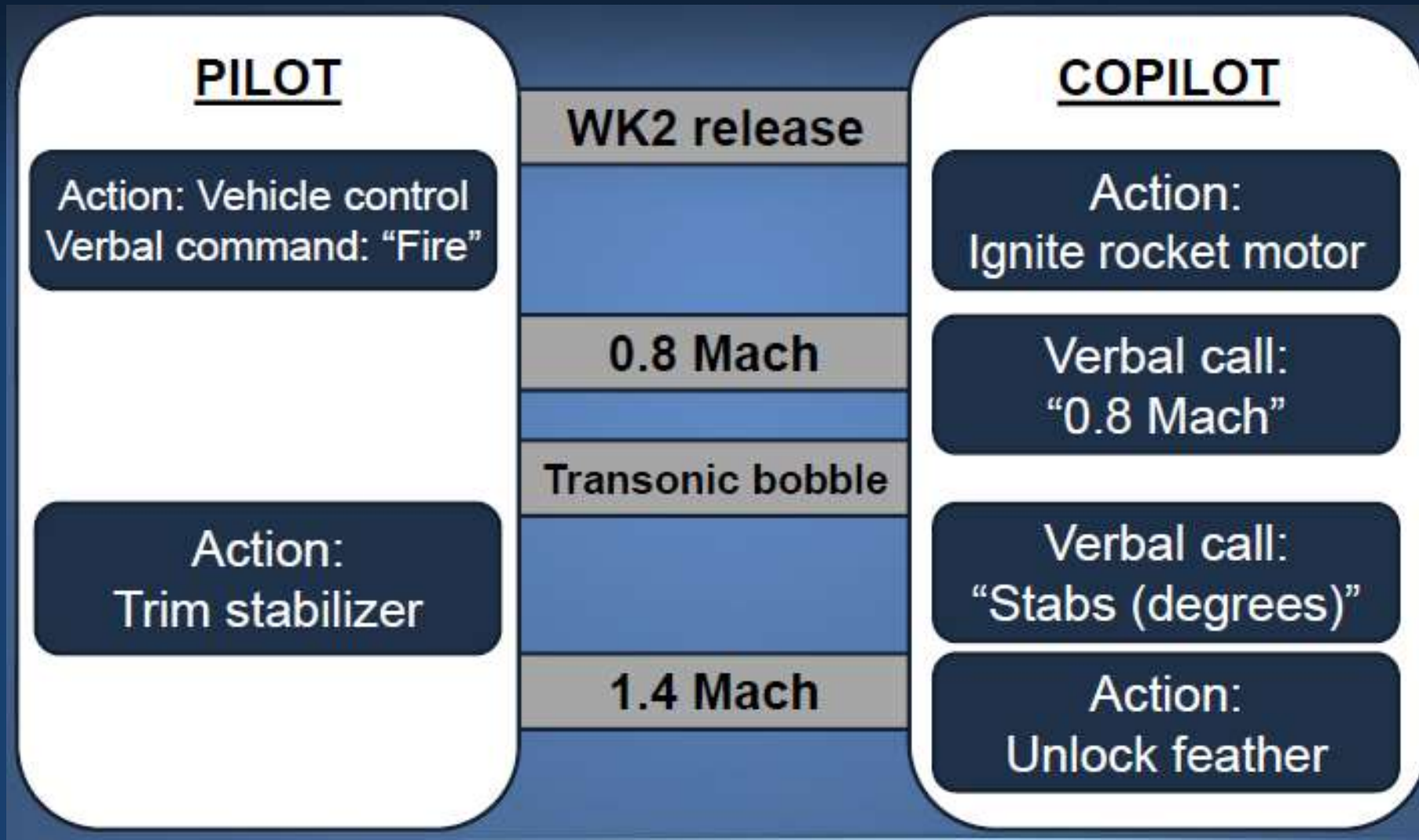


Feather Unlocked

The investigation found

- High emphasis on making sure feather was unlocked at 1.4 Mach.
 - Cockpit visual and aural alerting
 - Training and procedures
 - Mission abort if not unlocked by 1.8 Mach
- Not great concern placed on low speed unlocking.
 - Relied on pilots to do it right

Specified Flight Crew Procedures



- A single-point mechanical failure with catastrophic consequences would be unacceptable.
- However, Scaled Composites failed to consider that a single human error could be catastrophic.

NTSB Finding

“By not considering human error as a potential cause of uncommanded feather extension on the SpaceShipTwo vehicle, Scaled Composites missed opportunities to identify the design and/or operational requirements that could have mitigated the consequences of human error during a high workload phase of flight.”

NTSB Recommendation



Develop and issue human factors guidance for use during the design and operation of crewed vehicles.

